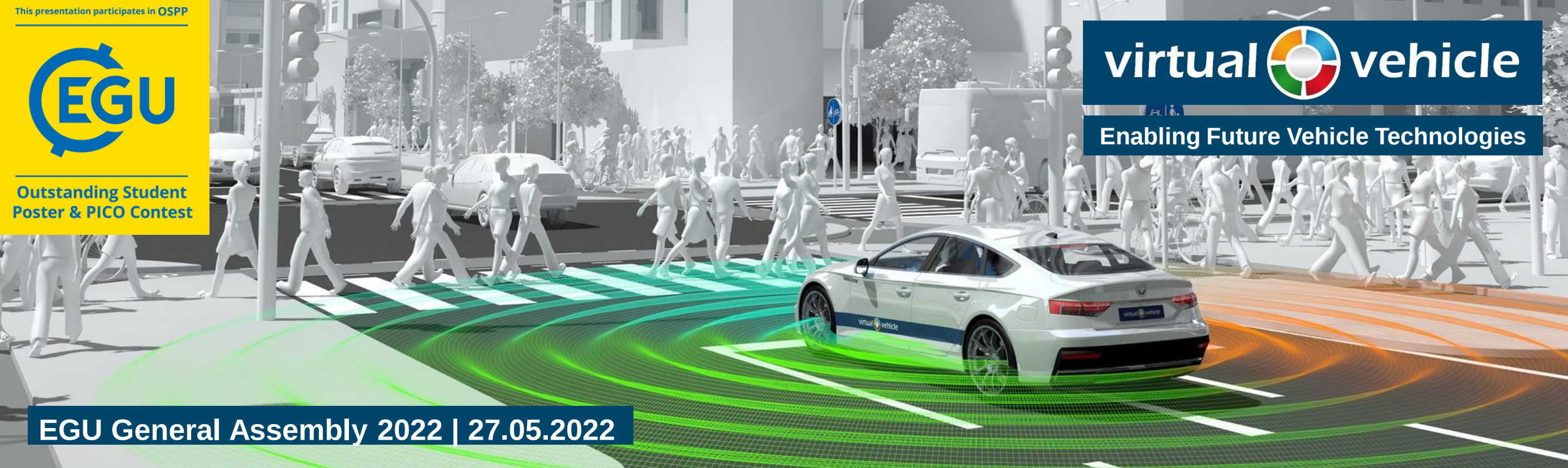




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Automotive lidar in the Arctic: 3D monitoring and mapping

Birgit Schlager^{1,2}, Thomas Goelles^{1,3},
Stefan Muckenhuber^{1,3}, Tobias Hammer^{1,3},
Kim Senger⁴, Rüdiger Engel⁵, Christian
Bobrich⁵, and Daniel Watzenig^{1,2}

¹ Virtual Vehicle Research GmbH, Austria

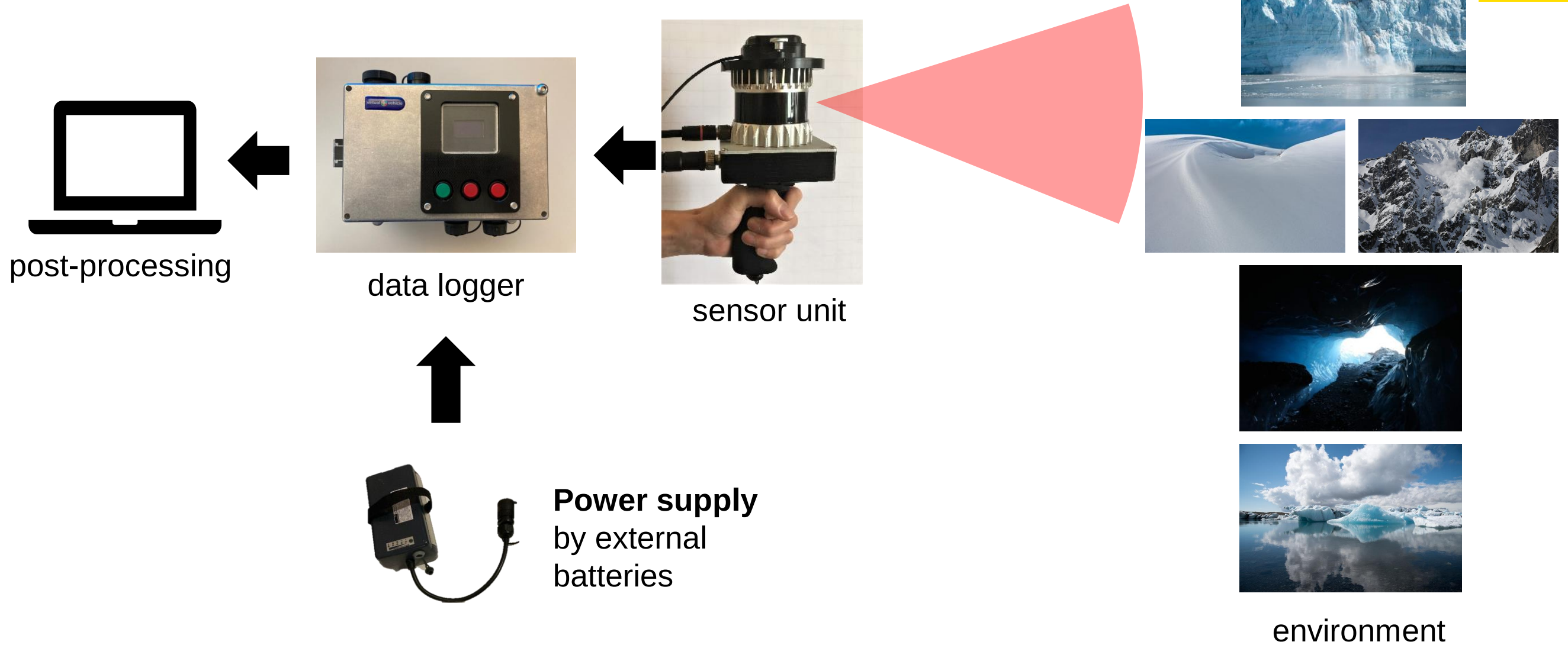
² Graz University of Technology, Austria

³ University of Graz – Department of Geography
and Regional Science, Austria

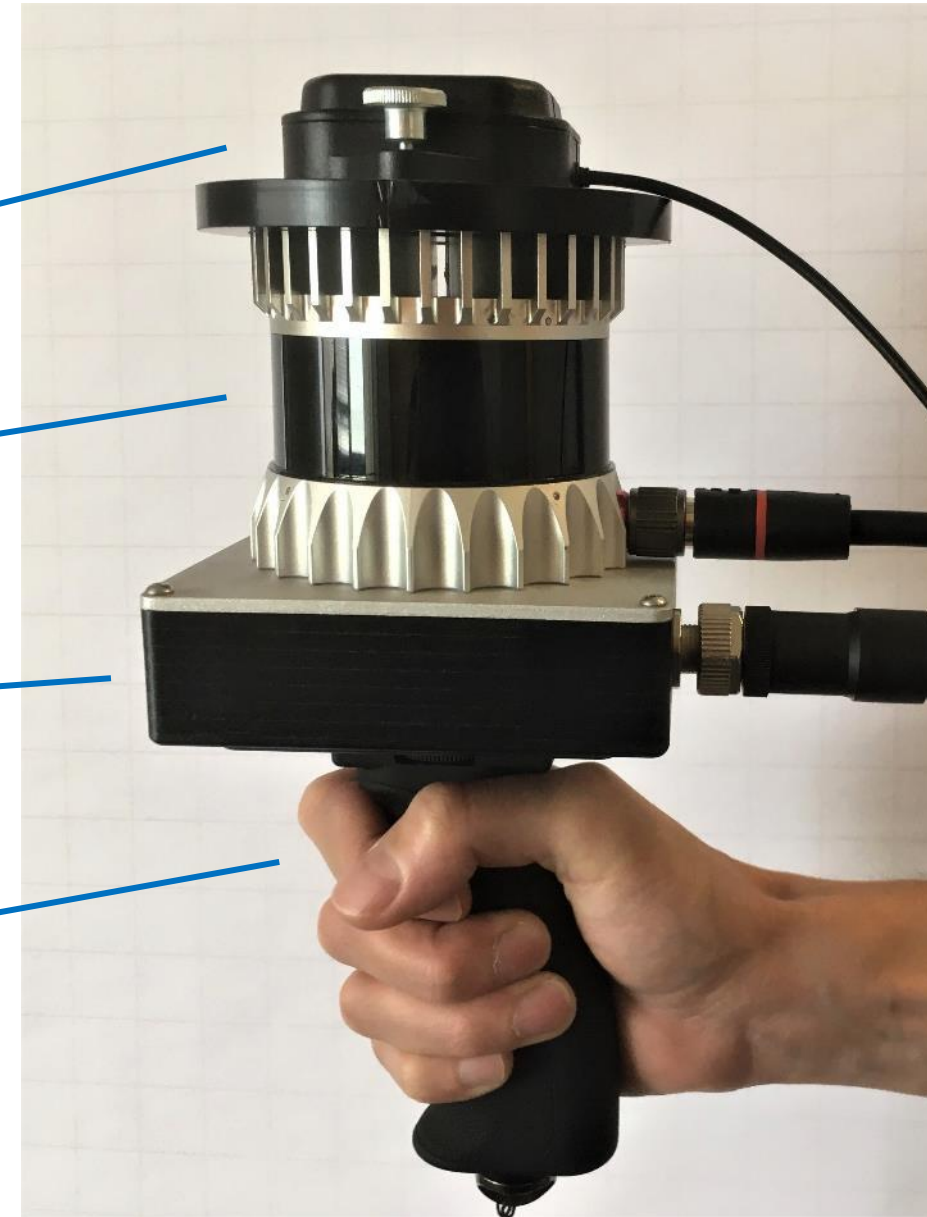
⁴ University Centre in Svalbard, Norway

⁵ FURUNO DEUTSCHLAND GmbH, Germany

Self-developed setup including an automotive lidar



- Ublox GNSS antenna
- Ouster OS1-64/OS2-64 lidar
- Xsens IMU
- Standardized $\frac{1}{4}$ inch screw →
can be mounted on handle,
helmet, tripod, ...



Hardware

- Raspberry Pi 4.0
- GNSS module
- SSD
- LTE stick
- OLED Display
- Real-time clock

Software

- Ubuntu 20.04 LTS
- ROS (Robot Operating System) Noetic Ninjemys



Conventional TLS

- High range, high resolution and accuracy
- Full waveform
- Low frame rate (1h)
- High price (EUR 150,000)
- Large size, heavy
- High eye safety class



Automotive lidar

- Medium range, medium resolution, medium accuracy
- High frame rate (10Hz)
- Low price (EUR 5,000)
- Compact size, light, robust
- Low eye safety class

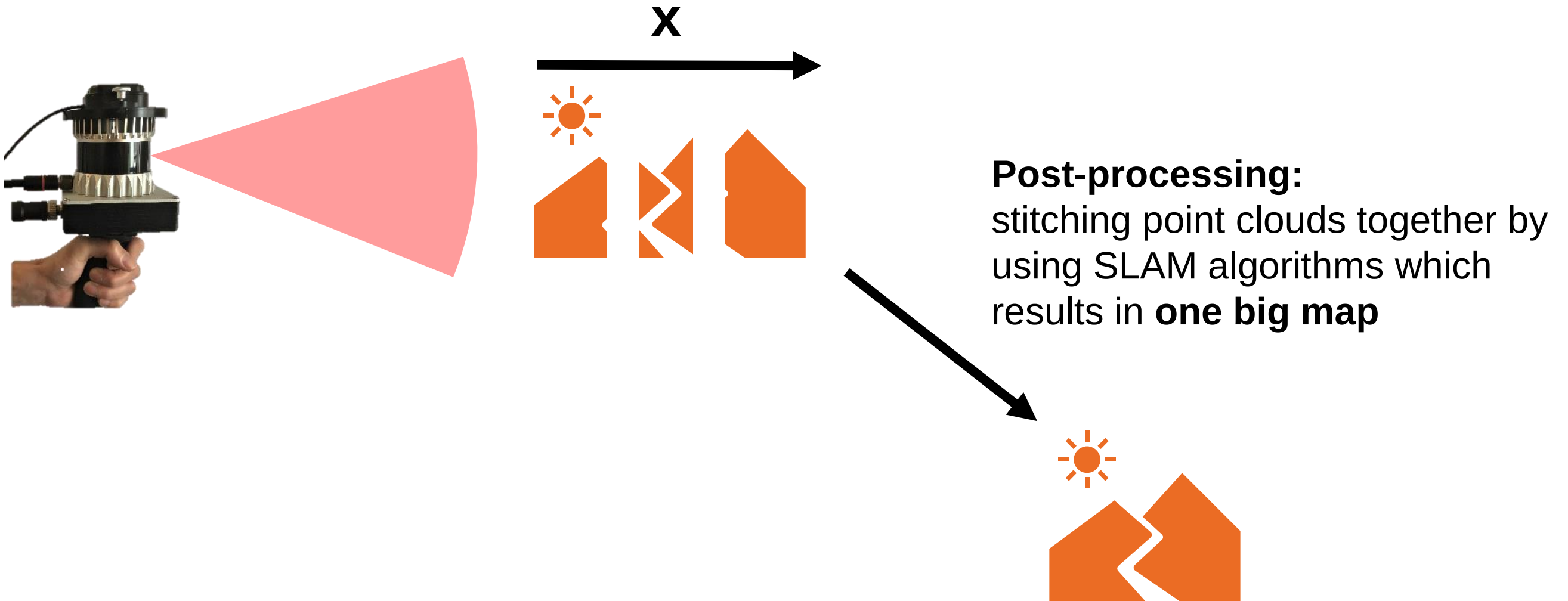


Monitoring with static sensor typically over a longer time span
but always the same area

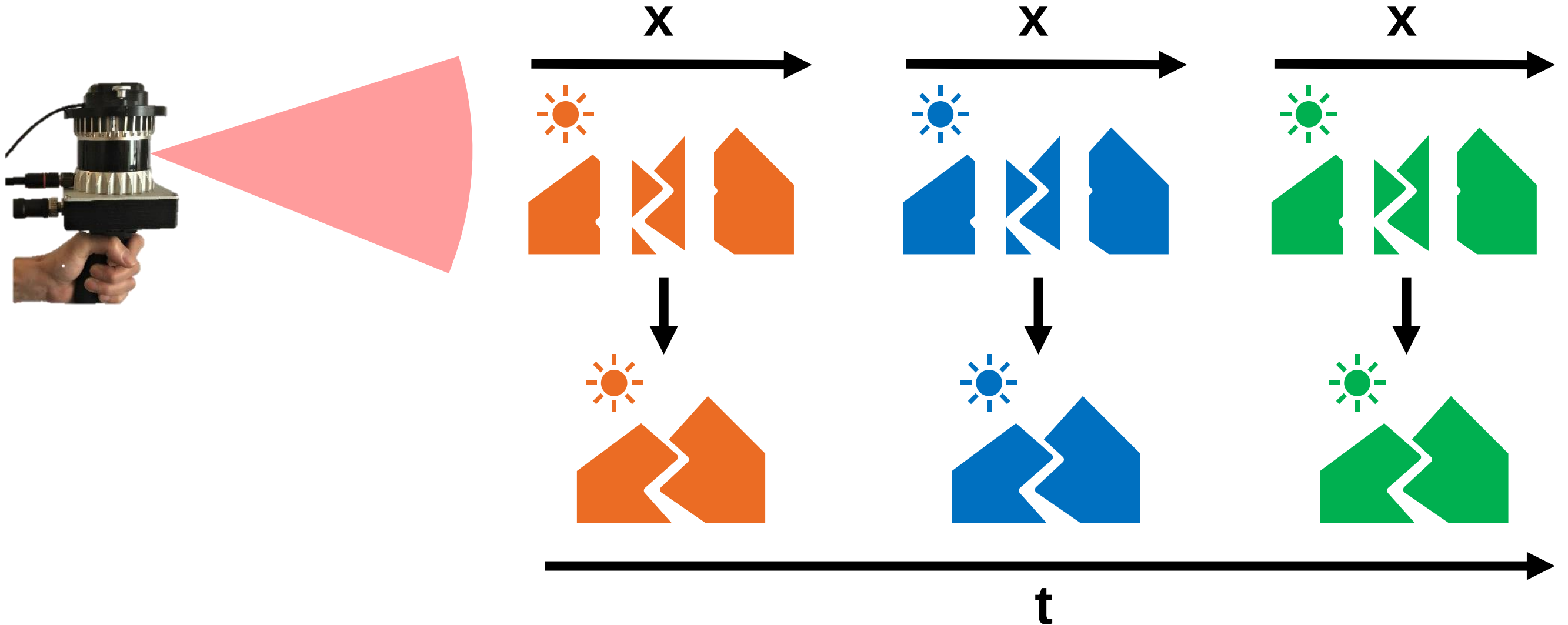


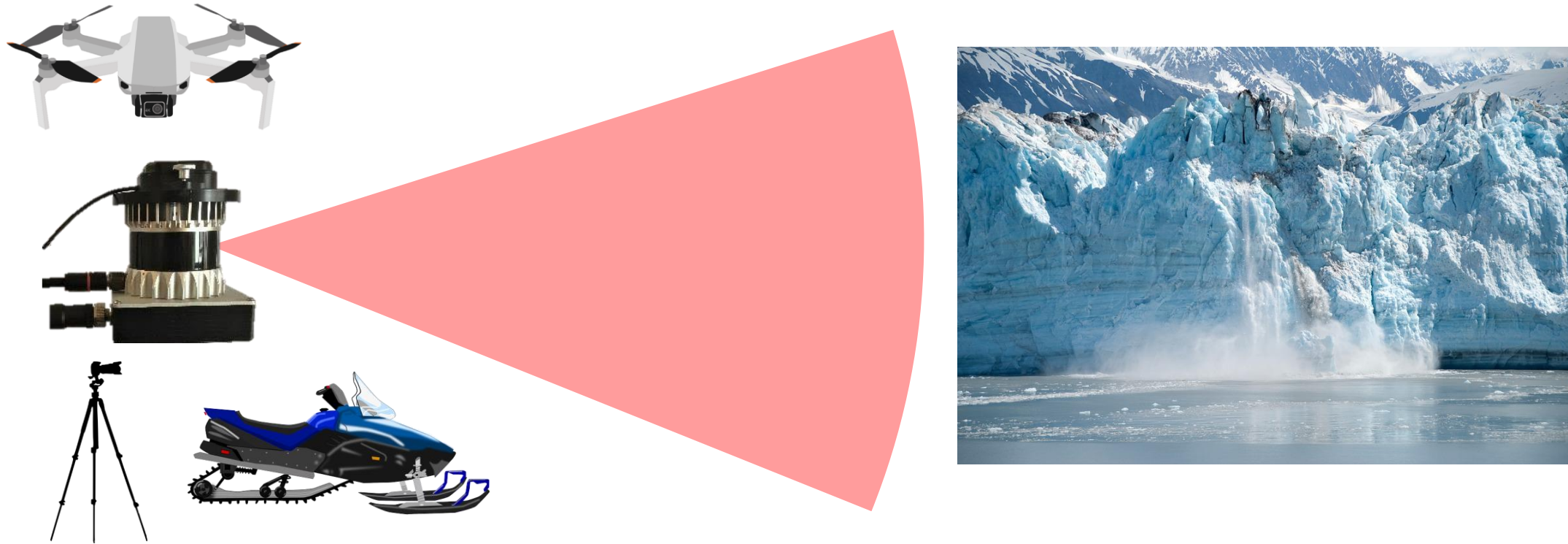
Post-processing with our python package:
<https://github.com/virtual-vehicle/pointcloudset>

Mapping with moving sensor to capture larger area of interest typically over a short time frame



Mapping with moving sensor and monitoring this larger area of interest over a longer period of time





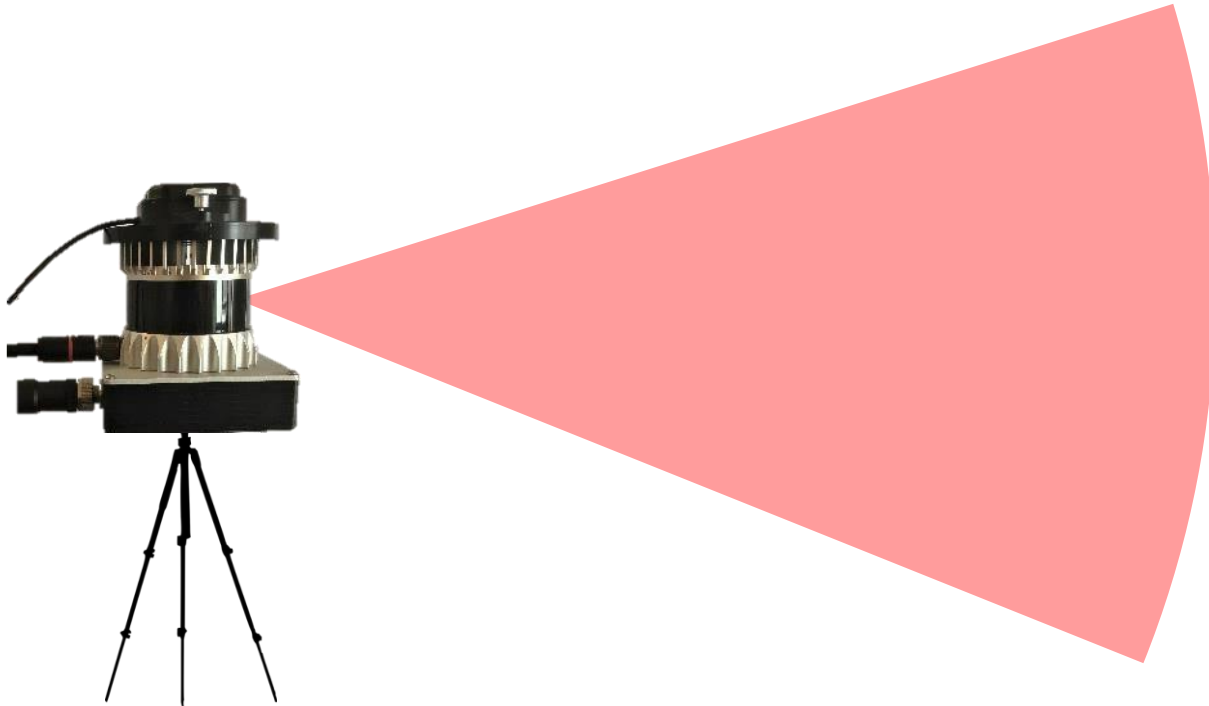
→ cost-efficient monitoring to quantify and better understand frontal motion and ablation



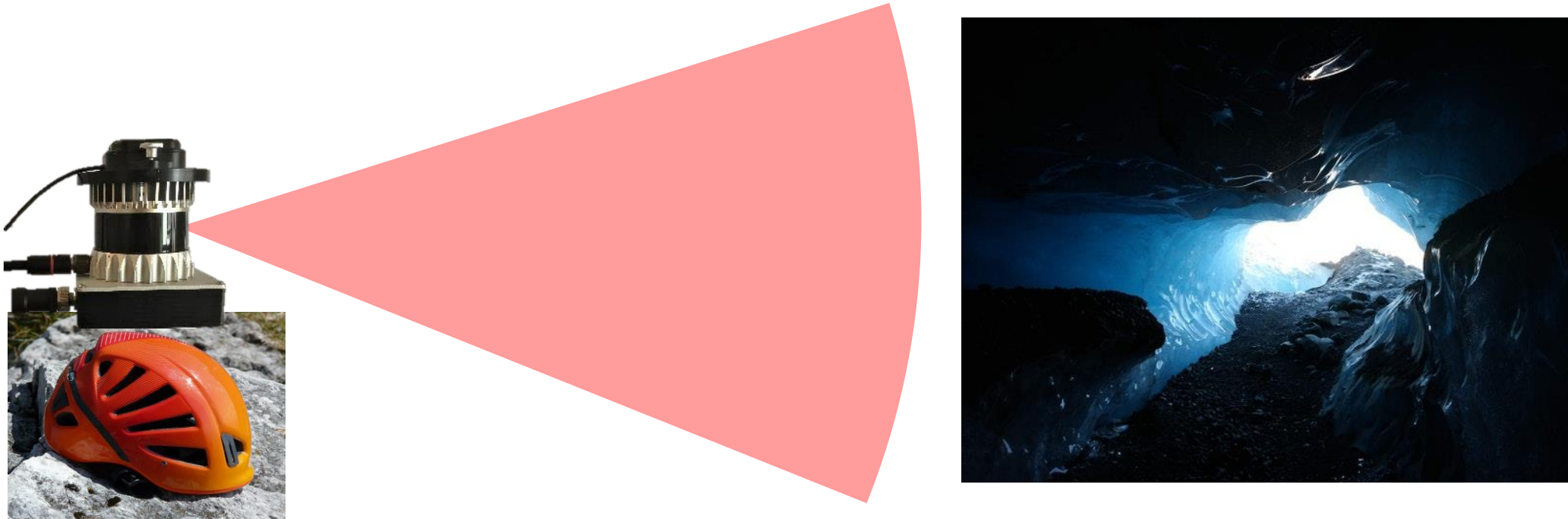
→ cost-efficient monitoring to support prediction of avalanche danger for individual slopes



→ cost-efficient monitoring for sea ice, sea ice ridge and iceberg detection on vessels and harbor monitoring systems

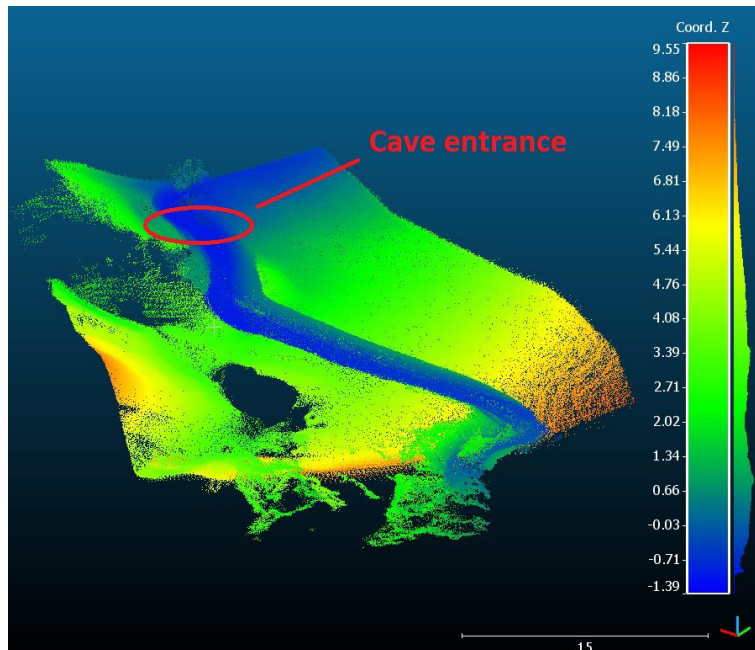
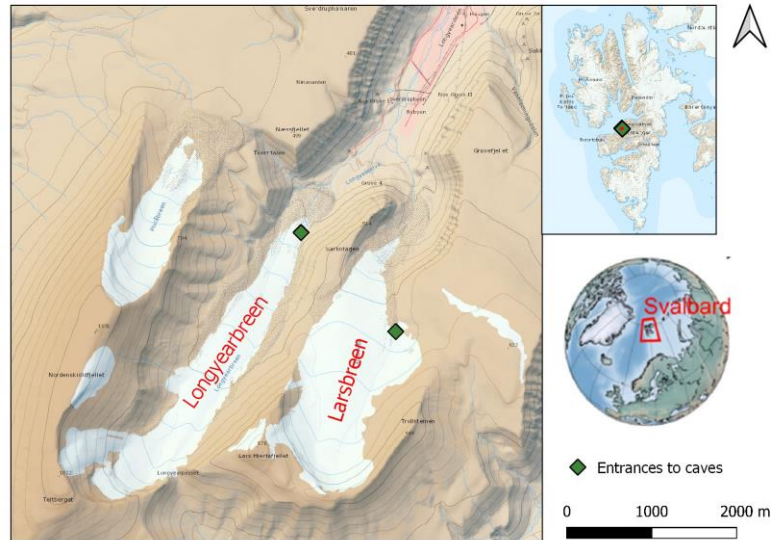


→ reliable and maintenance free measurements with high temporal and spatial resolution of precipitation type and amount

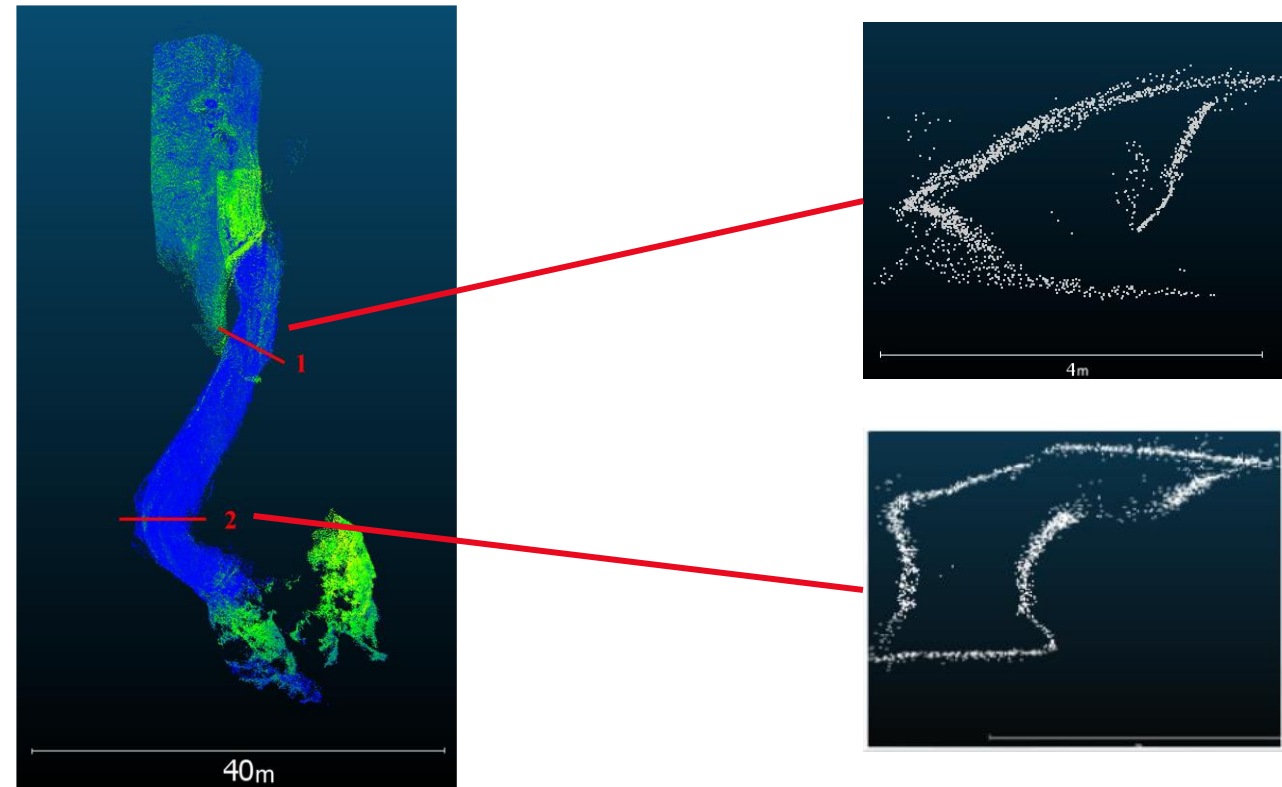


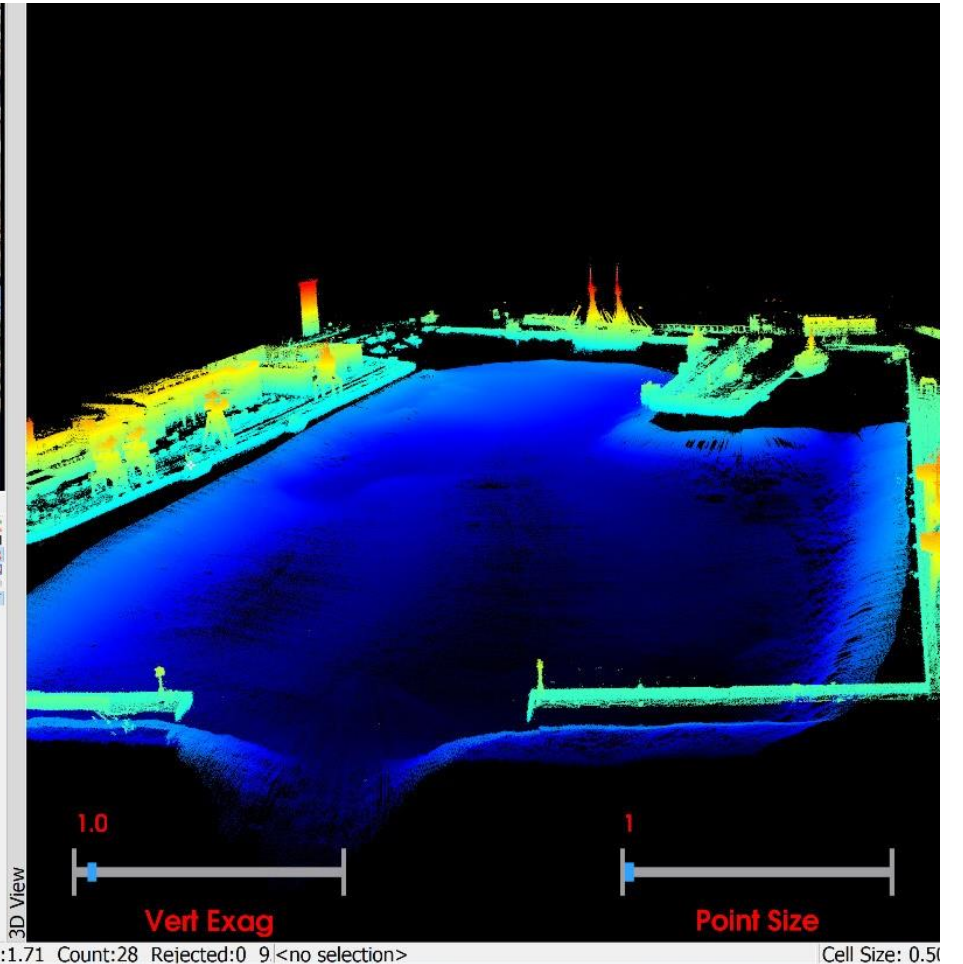
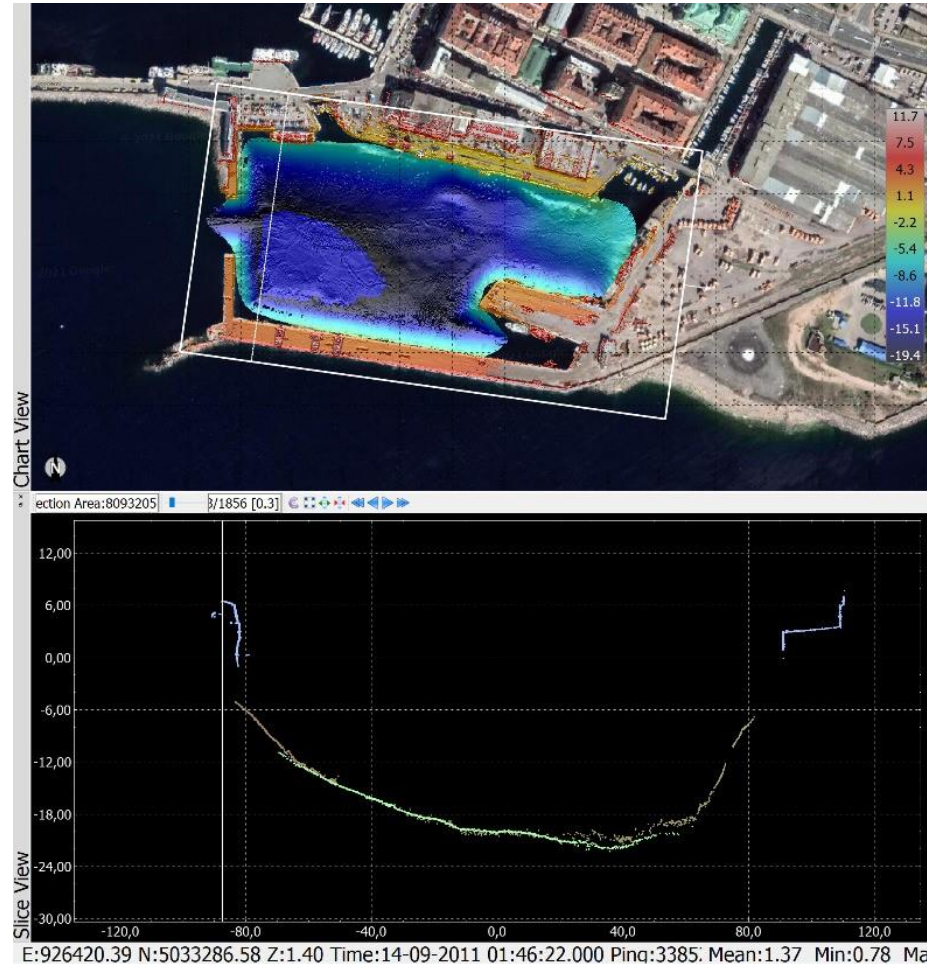
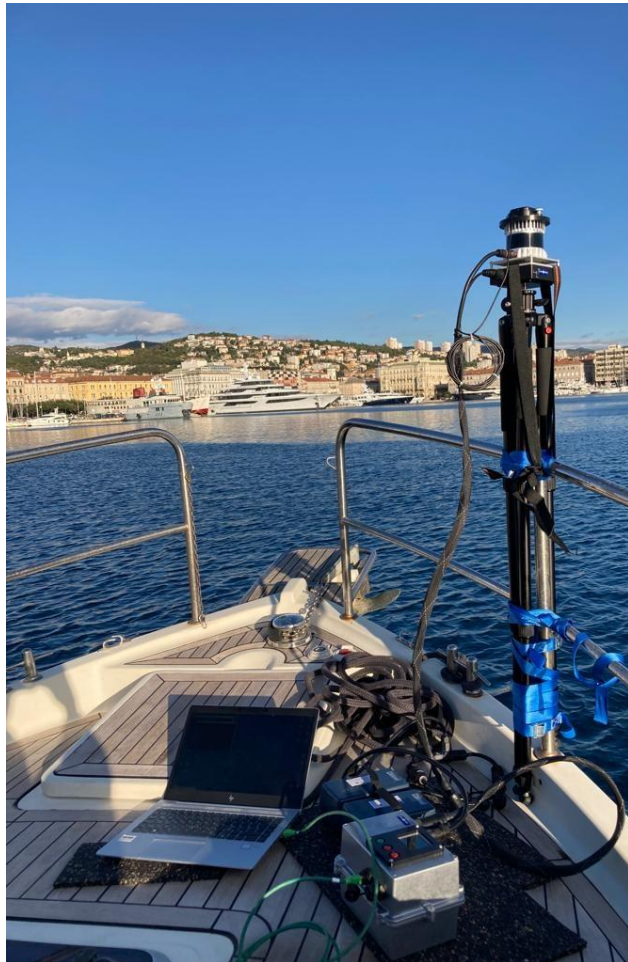
→ cost-efficient and detailed measurements for a better understanding of drainage systems inside a glacier

Overview of observed glacier caves



Mapping of glacier caves

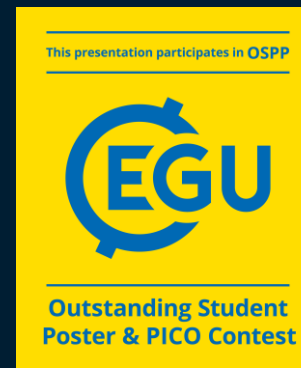




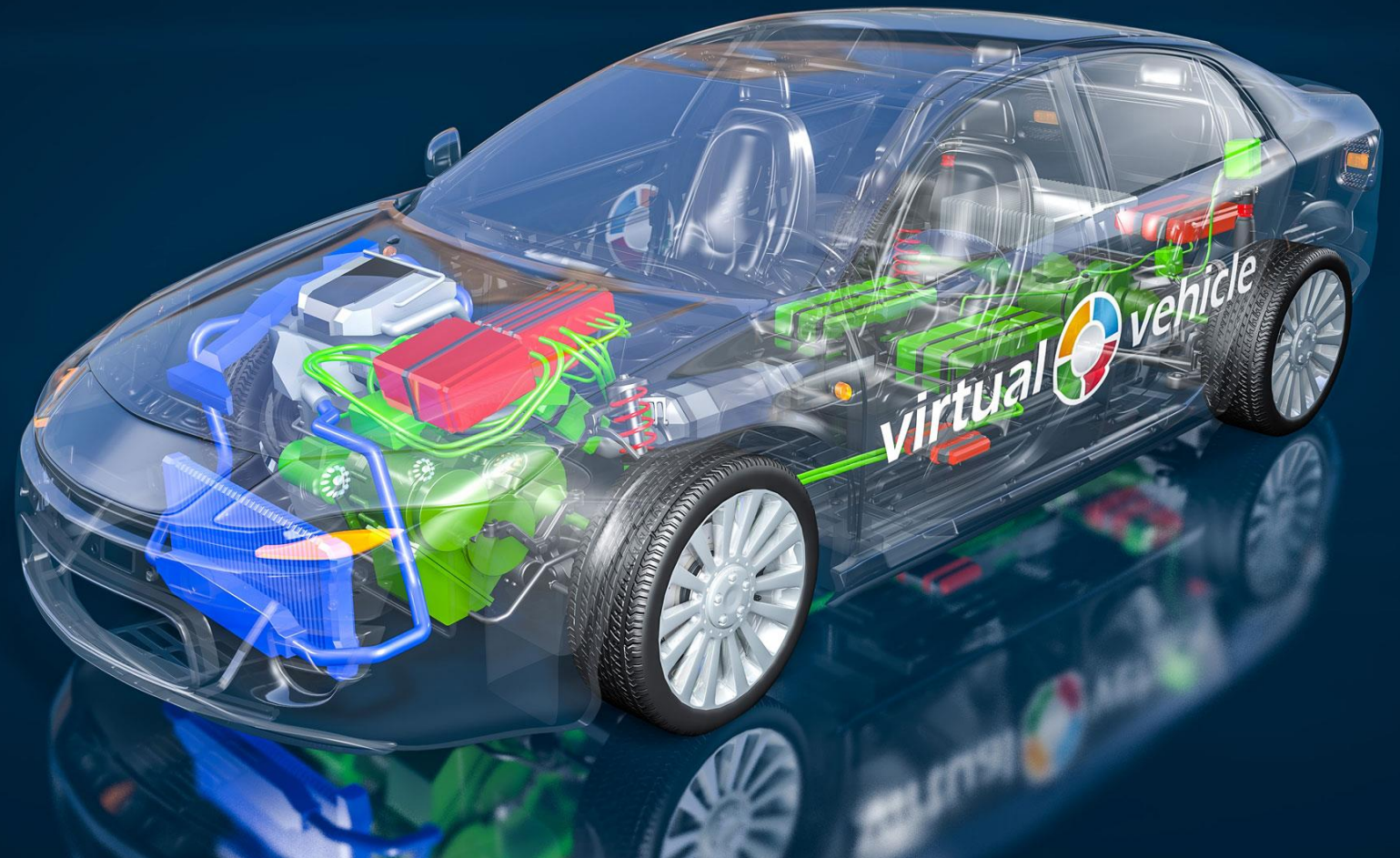
THANK YOU

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Goelles, T., Hammer, T., Muckenhuber, S., Schlager, B., Abermann, J., Bauer, C., Expósito Jiménez, V. J., Schöner, W., Schratter, M., Schrei, B., & Senger, K. (2022). **MOLISENS: a modular MOBILE Lidar SENSOR System to exploit the potential of automotive lidar for geoscientific applications**. Copernicus GmbH. <https://doi.org/10.5194/gi-2022-3>

Muckenhuber, S., Schlager, B., Gölles, T., Hammer, T., Bauer, C., Exposito Jimenez, V., Schöner, W., Schratter, M., Schrei, B., & Senger, K. (2022). **A stand-alone, modular Sensorbox to exploit the potential of automotive lidar for geoscientific applications**. Copernicus GmbH. <https://doi.org/10.5194/egusphere-egu22-1625>

Goelles, T., Schlager, B., Muckenhuber, S., Haas, S., & Hammer, T. (2021). **pointcloudset: Efficient Analysis of Large Datasets of Point Clouds Recorded Over Time**. In Journal of Open Source Software (Vol. 6, Issue 65, p. 3471). The Open Journal. <https://doi.org/10.21105/joss.03471>

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